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**METHOD, SYSTEM OF DEVICES, AND COMPUTER PROGRAM  
PRODUCT FOR THE DOCUMENT-RELATED EXTENSION OF A  
RESOURCE-STRUCTURED DOCUMENT DATA FLOW**

5 The invention concerns a method, a device system and a computer program  
product for processing of a document data stream that contains structured fields. A  
typical document data format of this type is the format AFP<sup>TM</sup> (advanced function  
presentation). It is in particular used in electronic print production environments,  
i.e. in data processing and printing systems that process document data with a  
10 speed of up to a few thousand pages per minute.

Such document production systems exhibit a high degree of automation. For  
example, a printing system with integrated quality checking is specified in US-A-  
6,137,967.

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Various print data streams and printing systems are, for example, specified in the  
publication "Das Druckerbuch", Dr. Gerd Goldmann (editor), Océ Printing  
Systems GmbH, 6th edition (May 2001), ISBN 3-000-00 1019-X. The server  
system Océ PRISMApro is specified in chapter 14. This flexible print data server  
20 system is, for example, suited to transfer print data from data sources such as a  
source computer – the print data in a specific print data language such as line data,  
AFP, PCL (Printer Command Language), PostScript, SPDS (Siemens Print Data  
Stream), or in the language LCDS developed by the company Xerox Coporation  
[sic] – to a print production system.

25

Details of the resource-structured document data stream AFP<sup>TM</sup> are specified in  
the publication Nr. S-544-3884-02, published by the company International  
Business Machines Corp. (IBM) with the title "AFP Programming Guide and Line  
Data Reference". This documentation is to be obtained via the address IBM  
30 Printing Systems Division, Dept. H7FE, Building 004M, Information

Development, PO Box 1900, Boulder CO 80301-9191 USA or via  
<http://publib.boulder.ibm.com/prsys/pdfs/54438842.pdf>.

The document data stream AFP was further developed into the resource-structured  
5 document data stream MO:DCA<sup>TM</sup>, which is specified in the IBM publication  
SC31-6802-05 (April 2001) with the title "Mixed Object Document Content  
Architecture Reference". This document is also accessible at the Internet address  
<http://publib.boulder.ibm.com/prsys/pdfs/c3168025.pdf>. Details of this data  
stream, in particular the use of structured fields, are also specified in US-A-  
10 5,768,488. In the framework of the present specification, no differentiation is  
made between AFP and MO:DCA data streams.

AFP/MO:DCA data streams are frequently converted into data streams of the  
format Intelligent Printer Data Stream<sup>TM</sup> (IPDS<sup>TM</sup>) in the course of print  
15 production jobs and transferred to a high-capacity printer in this format. Such a  
process is shown in US-A-5,982,997.

In the specification "UP<sup>3</sup>I; Universal Printer Pre- and PostProcessing Interface,"  
Version 1.02 (July 2002), published by the companies Duplo International Ltd.,  
20 Hunkeler AG, IBM Coperation [sic], Océ Printing Systems GmbH and Strålfors  
AB, which can be downloaded as a file at the Internet address [www.up3i.org](http://www.up3i.org), the  
most varied control commands are provided that can be used in the creation of a  
printed document to control various devices of a print production system such as  
printing devices and devices upstream and downstream from these, such as  
25 unwinders, cutting devices, hole devices, gluing devices and binding devices. It is  
thereby provided that such data are exchanged between the different devices, thus  
for example between a paper dispenser and a printing device.

On the pages 134 through 141 of the UP<sup>3</sup>I specification, examples are already cited  
30 as to how commands for print pre- and post-processing devices can be inserted into  
an AFP (MO:DCA) or, respectively, IPDS data stream. With the UP<sup>3</sup>I extensions,

AFP applications can now contain UP<sup>3</sup>I control commands that are transferred to a printer, whereby printer-specific data formats such as IPDS can be used. The UP<sup>3</sup>I control data are thereby initially mixed with the print data and are only separated from these in the printer. The further devices of the print production system, i.e.  
5 pre- and post-processing devices for the print good (such as paper dispensers, unwinders, stackers, punchers, folders, cutters and binders), can then be addressed via the UP<sup>3</sup>I interface.

New AFP applications can already be coded from the beginning such that UP<sup>3</sup>I  
10 functions are used. This is different than in older AFP applications. Such applications for standard expressions (such as, for example accounting printouts or account statements), applied in part for many years, must be changed when they should use UP<sup>3</sup>I functions.

15 From the IBM publication NR. S544-5284-06, "IBM Page Printer Formatting Aid: User's Guide", 7<sup>th</sup> edition, which is accessible at <http://publib.boulder.ibm.com/prsys/pdfs/54452846.pdf>, a tool is known with which a user can provide an existing AFP document data stream or, respectively, a format definition resource file "Formdef" located in this document data stream  
20 with additional commands. This occurs via a control file in which it is entered when what is known as a copygroup or, respectively, medium map with a specific name must be generated.

In this type of data enhancement, corresponding calls of the media map must  
25 respectively be stored in the file in which the variable data are situated in order to be able to let the commands generated in the formdef file act on the variable data. This manual reprogramming of the data stream can be a very complex event that is error-prone – primarily when a plurality (for example 3 or more) of copygroups are to be newly inserted. The effort thereby resulting for the user is substantial, and  
30 the danger of wrong inputs exists when media map calls are not correctly updated, for example not changed in synchronization with the entries in the formdef file.

Furthermore, it can occur that one and the same original data stream are processed with various print production systems, and this with various finishing possibilities. The application must then be re-adapted for the respective configuration of the  
5 print production system, which can lead to unwanted time delays under production conditions.

In the patent application Nr. PCT/EP02/05299, which the applicant submitted on 14 May 2002 with the title "Method, device system and computer program system  
10 for processing of document data", it is described how auxiliary data (such as, for example, barcodes) can be automatically inserted into a document data stream.

A conventional processing of an AFP print document data stream without support of finishing or, respectively, UP<sup>3</sup>I functionalities is shown in Figure 2. The various  
15 processing steps show what an AFP application designer (user) has to do in order to create an application: by means of a formatting computer program 20 (which, for example, can be the previously mentioned Page Printer Formatting Aid (PPFA) tool by the company IBM or the Smart Layout Editor (SLE) specified in the Druckerbuch introduced above) and a control file 21 with corresponding  
20 formatting parameters, the user generates a formdef file (resource) 23 that contains a copygroup (medium map) with the name ACCOUNT.

A print data file 22 that contains variable data is prepared by the user such that it is called [sic] the copygroup with has been applied with the control file 21 with  
25 structured fields of the type invoice [sic] medium map (IMM) "IMM Account", which stands between the variable data. Details regarding the structured field type IMM can be learned from the previously cited IBM document SC31-6802-05.

In the example shown in Figure 2, the print data file contains account statement  
30 documents for two different customers of a bank. For the first customer, the print data file 22 contains two account statements with respectively 9 pages and 6 pages.

For the second customer, an account statement document with 3 pages should be printed out. For this, the print data file 22 and the formdef file 23 are supplied to a host printer driver 24 that (in step S3) forms a print data stream of the format IPDS from both files and, if applicable, resource files such as, for example, fonts, with  
5 which print data stream an IPDS-capable printing system 25 is activated. In the shown example, the printing system 25 is controlled from a first printer 26 in which the front side of a web-form recording medium is printed and a second printer 27 in which the back side of the same recording medium is printed with the respectively associated data.

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In step S4, the previously cited documents are printed out, i.e. as a first document 28 of the first printout of the first customer that comprises five individual pages, three pages as a second document 29 for the first customer with the second account statement, and two pages as a third document 30 for the second customer.

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The same application as shown in Figure 1 is shown in Figure 3, whereby it is manually extended with additional commands for print pre- or, respectively, post-processing devices as they are provided in the UP<sup>3</sup>I specification. In the case of Figure 3, the finishing commands foil shrink-wrapping (shrink-wrap), page offset  
20 (left/right/shift) as well as document stapling (corner staple) are provided that should be applied on the printed print good or, respectively, parts thereof. Using Figure 3, it is described which operating steps are necessary when this goal is executed with the already specified tool by the company IBM, "Page Printer Formatting Aid" (PPFA) or with the Smart Layout Editor (SLE) known from the  
25 applicant.

In step S5, a new form definition file is generated by the user as a resource file with the Page Printer Formatting Aid tool (see above) or with the tool Small [sic] Layout Editor (SLE) that is specified in the previously introduced "Druckerbuch"  
30 by Océ Printing Systems GmbH. The parameters are specified in a PPFA control file 31 (in Figure 3, the control file 31 is subdivided into a first part 31a and a

second part 31b merely for representation reasons). The control file 31 shows that three copygroups (medium map fields) are necessary in order to be able to activate the desired finishing functions. The UP<sup>3</sup>I control commands for the foil welding, the offset and the stacking are part of the new medium map, for example

5 OPERATION SHIFT and REFERENCE left for the offset.

The PPFS control file 31 generated in the step S5 uses the PPFA computer program 32 in order to generate in the step S6 a formdef file in which are contained the copygroups (LI\_ACC1, LI\_ACC2 and RI\_ACC1) defined in the  
10 PPFA control file 31. These new medium maps replace the copygroup (medium map) ACCOUNT contained in the formdef file 23 in Figure 1.

In addition to the changes in the formdef file 23, the user must modify the print data file such that the structured fields Invoice [sic] Medium Map (IMM) are  
15 synchronized with the new medium map names. The user must thereby replace the respective old IMM call with a correct new IMM call that corresponds to the respective desired finishing operations. In the example of Figures 2 and 3, different calls are henceforth inserted in place of the respective identical calls 22a, 22b and 22c "ACCOUNT" for the three documents 28, 29, 30: the call IMM  
20 LI\_ACC1 34a, whereby the document is distributed and stapled to the left, is to be added to the document 28 and the call IMM LI\_ACC2 34b, whereby the document is deposited and stapled to the left, is to be added to the document 29. The call RI\_ACC1 is to be added for the document 30, whereby the document is deposited and stapled to the right. This association must occur manually in the print data file  
25 when the print data file exists already or has the structure 22 shown in Figure 1. Otherwise, the print data file would have to be completely newly generated via a corresponding application program, which is, however, very time-consuming under the circumstances. For synchronization, it is thus necessary that copygroups a) are present, b) have matching parameters for formdef file in the data stream and c)  
30 their calls are situated at precisely the right point of the print data stream.

In step S8, the formdef file 3 and the print data file 34 are in turn converted by the host printer driver 24 from the AFP format into an IPDS print data stream and sent to the IPDS-capable printing system 25. The commands, which apply to the pre- or, respectively, post-processing devices (UP<sup>3</sup>I commands) and that are contained  
5 in the medium map, are converted into corresponding IPDS/UP<sup>3</sup>I triplets before they are sent to the printer. As already in Figure 2 [sic], the resulting printed documents 28, 29, 30 are grouped, whereby in the case of Figure 3 the pages are stapled and shifted group-by-group, and all are shrink-wrapped together in a protective covering as this has been specified by the user.

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The labeled bars 35, 36 show the respective post-processing steps of the ancillary documents.

A user that would like to extend an AFP print data stream with post-processing  
15 functionalities (for example UP<sup>3</sup>I) with the method shown in Figure 3 must have the original PPFS control file available and furthermore have access to the user program that has generated the original print data stream. However, this is not always given. It is therefore a requirement to expand existing AFP print data streams with additional device functionalities in order to enable an optimally  
20 automated process for generation of more complex documents without having to access old control files or, respectively, user programs that were decisive in the generation of the data stream.

To recapitulate, it is to be established that the user must implement at least the  
25 following steps in the method shown according to Figure 3:

- a) He must change existing copygroups which contain a finishing operation.  
Tools such as the computer program PPFA are available for this.
- b) He must add new copygroups that are respectively situated at the beginning  
30 of a finishing operation or indicate their continuation and



- c) he must modify the print data stream in order to call the modified or, respectively, inserted medium maps (copygroups).

The steps cited above are all the more elaborate the larger the respective  
5 application, i.e. the more documents that are contained in the application and/or the  
more medium maps/copygroups that are contained in the formdef file. Typical  
AFP applications are comprised of multiple thousands (up to hundreds of  
thousands) of pages. A typical AFP formdef file contains a plurality of medium  
maps, for example in what is known as a mixplex [sic] job, in which various paper  
10 feeder bays and/or simplex/duplex print commands alternate within a print job.  
Effort and susceptibility to error are therefore very high under the circumstances  
given the preparation of such print data streams.

Possibilities for insertion of information into a MO:DCA data stream are specified  
15 in US-A-5,768,488. Furthermore, in the article PrePress, published 8/99, pg. 18-  
27, it is specified that the host input module of the program "Hausdruckerei  
Manager", vers. 6.1 by the system vendor Danka allows the addition of  
information that are not contained in AFP/IPDS data streams, for example  
commands for duplex printing and end processing.

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A method for enhancement of a document data stream with data for peripheral  
devices is known from DE 100 24 523 A1.

The previously cited publications and patent applications are herewith incorporated  
25 by reference into the present specification.

It is the object of the invention to automate the insertion of finishing operations  
into existing structured document data streams.

30 This object is achieved via the invention specified in the independent claims.  
Advantageous embodiments of the invention are specified in the sub-claims.

To enhance with finishing commands an input document data stream that comprises at least one input format file containing format definitions as well as an input document file structured in ranges and/or sub-ranges and containing variable  
5 data, it is provided that a control file is applied in which the level structures are defined that correspond to the ranges and/or the sub-ranges of the input document file. Furthermore, in the control file the finishing commands are associated with the levels, such that the following files can be automatically generated with a computer program module using the control file, the input format file and the input  
10 document file:

- (a) an output format file that contains the finishing commands in callable groups, and
- (b) an output document file containing the variable data and group calls  
15 associated range-by-range or sub-range-by-sub-range.

One advantage of the invention with regard to conventional methods is that the user does not need to modify existing print production jobs himself. In particular AFP applications can generate print data entirely independent of the site and the  
20 type of their printout. Additional finishing commands for devices for pre- or, respectively, post-processing of print goods in the print production process are extended in a data enhancement process with new or existing print data streams, which in particular can occur in a production-in-time event just before the print job is actually processed. Via the automation of the event to the greatest possible  
25 extent, an inventive data enhancement process can be rapidly triggered, whereby the process speed can be between 10,000 and 50,000 pages per minute. A complete, immense print job can thereby be prepared within only a few minutes, such that it can fully or partially use the capabilities of a print production path with complex design. In addition to the enhancement of print data with finishing  
30 commands, the data can be enhanced (in particular via the same computer program module) with further control data more or less independent of the print path, for

example with franking data for postal shipments or with barcode data for detection of generated documents in later method steps. For this, the invention can in particular be combined with the method or, respectively, system of the previously cited PCT/EP02/05299 in which, in a method, system or computer program for  
5 processing of a document data stream, a series of function stages are used in order to enable a fast, secure output of the documents in a production environment, in particular in a print production environment. The content of this patent application is herewith again explicitly referenced.

10 The invention is based on the realization that, in a structured input data stream that should be enhanced with complex finishing commands, the existing document structure can be utilized, and via allocation of ranges or sub-ranges of the document data stream, a corresponding association of finishing commands range-by-range is possible. According to a further aspect of the invention, for allocation  
15 a control file is provided in which document levels on which specific finishing commands should be applied are defined independent of the concrete structure of the document input file. This event can hereby be automated very well and in particular be automatically prepared for large to very large print data streams (for example print data streams containing tns [sic] of thousands to millions of  
20 documents).

A user who wants to expand a resource-structured document data stream with finishing operations is inventively provided with a tool (computer program, editor) with which he can specify the finishing operations that are to be implemented.  
25 Parameters that more precisely specify the operation can hereby be provided. Furthermore, the user can specify the location and the range (or the levels) within the variable print data stream in which the finishing operation is to be applied. Furthermore, the necessary finishing commands (copygroups, medium maps) are automatically inserted into the format definition file (formdef) by a computer  
30 program module. Finally, the processing calls (medium map invocations [sic]) contained in the document data file containing variable data are modified or,

respectively, inserted such that the finishing operations (copygroups) incorporated into the format definition file are invoked instead of the original calls contained in the variable document data file.

- 5 Due to the high degree of automation of the replacement of prior processing calls with the supplemented calls with additional functionalities, errors are largely to be eliminated. Existing processes for generation of document data do not need to be modified. In that the user only needs to specify the new available finishing operation commands on a relatively simple interface (editor, graphical user
- 10 interface GUI, computer program) and the insertion of corresponding calls into the document data file occurs automatically, even very complex and large document data files can be adapted to the new possibilities in the range of the pre-processing and post-processing of print goods with only slight effort of the operator.
- 15 In a preferred exemplary embodiment of the invention, the input document data streams and/or the resource-structured output document data stream are an Advanced Function Presentation<sup>TM</sup> data stream. With the invention, it is thereby in particular possible to enhance other input document data streams such as, for example, line data, PCL data or Postscript data with finishing commands, if
- 20 applicable to take over finishing commands already integrated there or to overwrite and/or to generate finishing commands on the output side in an Advanced Function Presentation<sup>TM</sup> data stream. It can be provided just as well in the reverse, that on the input side an Advanced Function Presentation<sup>TM</sup> data stream exists and this is to be converted at the output side into a different resource-structured output data
- 25 stream.

Further aspects and advantages of the invention are made clear via the subsequent specification of embodiments of the invention with some Figures. Similar elements are – as before – thereby provided with similar reference characters for

30 easier understanding.

Thereby shown are:

Figure 1: a high-capacity printer system,

5 Figure 2: conventional technique for processing of a structured data stream,

Figure 3: conventional technique for propagation of a structured data stream  
with finishing commands, and

10 Figure 4: inventive technique for automated enhancement of a structured data  
stream with finishing commands.

A document print production system 1 is shown in Figure 1 that on the one hand  
comprises a mainframe architecture 2 and on the other hand comprises a network  
15 architecture 5 in which document data or, respectively, document print data stream  
are respectively generated by means of user programs (tools). In the mainframe  
architecture, these print data are generated by a host computer 3, in particular as an  
AFP print data stream or as a line print data stream. The print data can  
alternatively be transferred directly from the host computer 3 to one or more print  
20 devices 6a, 6b via what is known as an S/370 channel 14a. As an alternative to this  
output channel, the print data can also be transferred from the host computer 3 to a  
processing computer 4 via a network 13 or a direct data connection 14b, in which  
processing computer 4 the print data are buffered (for example in an associated file  
server) and processed for subsequent output steps. In such host computers 3, in  
25 particular print data streams are generated that are assembled from larger data  
stocks (databanks) of regular list expressions, calculations, consumption overviews  
(for telephone accounting, gas accounting, bank accounts), etc. Such applications  
have frequently already been in use for many years and, as before, necessary in  
a more or less unchanged manner (what are known as legacy applications).

The print production workflow is monitored by a monitoring system 7 within the mainframe architecture 2. Said monitoring system 7 comprises a monitoring computer 7a that is coupled with a databank 7b and contains various computer program modules 7c (compare Figure 2).

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The monitoring system 7 is connected with the host computer 3 via a device controller network 15 and a print manager module 8 as well as via a converter 9 with a V24 data line that connects to both of the print devices 6a, 6b. The converter 9 converts the V24 signals into DMI protocol signals of the device controller network 15. SNMP protocol signals can be provided to the device manager DM converted as DMI protocol signals or, respectively, can be directly passed as SNMP protocol signals.

Print good 19 that has been generated in the printers 6a, 6b from the document print data stream and on which barcodes are printed can be respectively scanned with a manually movable, radio-controlled barcode reader 11a. The signals are transferred via radio to the read station 10a and transferred into the device controller network 15 or, respectively, to the monitoring system 7. Readers for one-dimensional and/or two-dimensional barcode systems can be used as barcode readers, such that various barcode systems can be read with one and the same read device. The barcode reader system is in particular configurable, i.e. adaptable to various application-specific codes or, respectively, the respective suitable control methods.

25 Document data are generated in the network architecture 5 by means of user programs in client computers 12, 12a that are connected among one another via a client network 13 as well as with the processing computer (file server) 4. The file server therewith serves as a central handling and processing interface for print data of the entire print production system 1. Diverse control modules (software programs) run on it, via which control modules the entire print production workflow or, respectively, the entire document processing is optimally adapted to

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the respective conditions in a manner that is application-specific, production-related and takes place at the device controller.

In particular the following functions, which are specified more precisely in  
5 connection with subsequent Figures, are executed in the file server:

1. Converting Indexing Sorting

In this function, incoming print data are converted into a uniform data format,  
10 indexed according to predetermined parameters and re-sorted in a predetermined  
sorting sequence. This in particular enables the re-sorting of the data streams  
optimized for the subsequent document output, for example the merging of various  
pages that are not in succession in the input data stream to be sorted together into a  
mail piece, such that they can, for example, be enveloped together into a  
15 correspondence (for example in an enveloper 22b).

2. Insertion of control information

In this function, control information, in particular barcodes, are inserted into the  
20 data stream, using which control information a data group belonging together (for  
example page, sheet, document, mail piece) can be recognized as such and be  
unambiguously localized in the production process at the various processing  
stations.

25 3. Data reduction

With this function, control data that have been delivered in the input data stream  
from the host computer 3 or, respectively, user computer 12 to the processing  
computer 4 can be filtered to the effect that such control data that are not necessary  
30 in the given overall system arrangement are removed. Via the connection of all  
participating output devices (printer 6a through 6d, cutter 22a, enveloper 22b) via

the device controller network 15, it can already be decided in the processing computer 4 which control data of the input data stream is [sic] needed by none of the connected devices. Via removal of this data from the data stream, the data stream can be reduced overall, in particular when only empty field entries  
5 regarding corresponding control data are contained in the input data stream.

#### 4. Extraction

With this function, predetermined data can be filtered or, respectively, separated  
10 out from the output data stream, whereby a compressed data stream (compressed data) is created, in particular for control and status data, that can be exchanged with very high speed between the participating devices and the monitoring computer. It is hereby possible to execute the monitoring of the participating devices in real time.

15

The functions 1. – 4. can largely be automatically implemented by a computer program module “CIS” (Converting, Indexing and Sorting), which is gone into again in detail later.

#### 20 Repeated print (reprint)

When, in the course of the further processing of the data, in particular in the output of the data on one of the print devices 6a, 6b, 6c or 6d, an error occurs in one of the post-processing devices 18a, 18b or also in the print computer 16, this can be  
25 determined by the monitoring system 7 using the control barcodes inserted into the processing computer 4, and the reprint of the documents (pages, sheets, mail pieces) affected by the fault can be requested. This reprint request is decisively controlled in the processing computer 4.

30 Print data that have been completed by the processing computer 4 are conveyed via the print data line 14c to a print server 16. Its task is essentially to unload the



processing computer 4. This occurs via buffering of the completed print data until its recall via the data line 14d to one or both printers 6c, 6d. The print server 16 is thus integrated into the overall system predominantly for reasons of performance (speed). In systems whose print speed is less high, the print server 16 can also be  
5 foregone.

Document data that are transferred to the printers 6c or, respectively, 6b and there are printed on a recording medium (for example paper) are, in the overall system, supplied to further processing steps, namely the cutter 18a and the enveloper 18b  
10 of the further processing. The print production process is therewith concluded.

The printed documents are tested with a test system 17 with regard to various criteria on their processing path between the print device 6 and the last post-processing device 18b, namely via an optical test system 17a with regard to their  
15 optical print quality, with a barcode test system 17b with regard to their existence, their consistency and/or their sequence, as well as with an MICR test system 17c insofar as the print was printed by means of magnetically-readable toner (magnetic ink character recognition toner). The data of the various test systems provided by  
20 the test system 17 are transferred from a mutual, serial data acquisition module (serial delta [sic] acquisition module) 17d to the device controller network 15 and supplied to the monitoring system 7. There the respective system data are acquired and the devices are checked in real time, and the respective positions of the documents are tested with regard to their correctness relative to the print job.

25 Further details of such a test system 17 are specified in the US patent Nr. 6,137,967 or, respectively, in the patent application corresponding thereto. The content of this patent or, respectively, these patent applications is herewith incorporated by reference into the present specification.

30 The finished printed documents 23 can in turn be registered with a barcode reader 11b that is connected, radio-controlled, with an associated control device 10b,

which in turn delivers its data to the monitoring system 7 via the device controller network 15.

Using the input print data file 22 and the input formdef file 23, which have already  
5 been the basis for the specifications of Figures 2 and 3, in Figure 4 it is shown how  
an output print data stream is inventively generated in the data format AFP. For  
this, it is initially helpful once to consider the data structure in the input print data  
file 22 in more detail. With the bracket 40, all data of the print data file, the largest  
coherent range of the print data from the command "beginning of job" to the  
10 command "end of job", are bracketed. The AFP print data stream is then divided  
up into subsequent sub-ranges that respectively signal more or less large  
documents belonging together such as, for example, mail pieces or pages. The  
invention utilizes this range-oriented structure. In the example of the print data file  
22, a first range is opened via the command "BNG Customer" and closed via the  
15 command "ENG Customer". Bracket 41 shows this range. Within this range,  
there are sub-ranges "Account" that are respectively begun or, respectively, ended  
via the commands "BNG Account" and "ENG Account"; see brackets 42 and 43.  
Within the account range, various pages are then respectively structured in turns  
with the commands "BP" and "EP" for beginning of the page and end of the page.  
20

The second customer range that is designated with the bracket 44 is located on the  
same hierarchy level as the customer commands, which were designated with the  
bracket 41. It also has a sub-region "Account" that is comprised by the bracket 45.  
In order to also map this data structure of the print data file in the control file 46,  
25 there levels are defined with the commands "Define level". The highest level  
(Level\_A) is thereby the entire print data file 22 that is encompassed with bracket  
40. The highest range (Customer) of the print data file 22 is subdivided into a first  
customer range that is encompassed with bracket 41 and a second customer range  
that is encompassed with bracket 44. Corresponding to the desired processing  
30 schema for the documents stored there (see Figures 1 and 2), whereby the  
documents of the first customer should be offset to the left and the documents of

the second customer should be offset to the right, two different levels must be defined within this range level in the control file 46, namely one level that corresponds to all uneven-numbered calculations within the first group level (see also customer bracket 41) and a second level that corresponds to all even-numbered calculations within the group level 1 (compare also second customer bracket 44).

Finally, in the control file 46 the various finishing operations are associated with the previously-defined levels: in the example of Figure 4, the level "Level\_A" with the finishing job "Shrink", the level "Level\_B1" with the finishing job "Left/Shift" and the level "Level\_B2" with the finishing job "Right/Shift" and the level "Level\_C" with the finishing job "Staple".

The control file 46 completed in step S7 contains three data ranges, namely a first data range 47 in which are defined the various finishing operations that can be executed by print pre-processing or, respectively, post-processing devices, a definition range 48 for levels in which are defined various levels of the structured input data stream 22, and a device range 49 for the associations that should be made between the finishing operations 47 and the defined levels 48 or, respectively, which finishing operation commands should be inserted into which levels of the structured data stream file 22. As soon as the user has completed the control file 46, with the CIS computer program module 50 in step S9 a new formdef file 51 can be automatically created from the print data file 22, the formdef file 23 and the control file 46, and in step S10 a new print data file 52 can be simultaneously generated. The new copygroups LI\_ACC1, LI\_ACC2 and RI\_ACC1 are generated from the formdef file 23 and the finishing operations specified in the control file 46. Furthermore, the CIS computer program module 50 effects that the modified print data file is generated from the print data file 22 and the definition range 48 for levels as well as the definition range 49 for associations. For this, the CIS computer program module 50 (CIS stands for Converting Indexing and Sorting) [sic], see also the specification regarding Figure

1), [sic] examines the input print data file 22 with regard to its logical, hierarchical structure and assigns the levels to the various data ranges, i.e. the level Level\_A to the entire document corresponding to the bracket 40, Level\_B1 to the data range of the bracket 41, etc. Using this association and the associations made in the  
5 definition range 49, corresponding finishing commands that have been defined in the range 47 can be inserted into the print data file 22 at exactly the right positions, such that the print data file 52 is created. The CIS computer program module 50 thus uses the information that are contained in the control file 46 and modifies the medium maps "Account" that were contained in the original formdef file 23 and  
10 their corresponding calls in the original print data file 22 "IMM Account" and modifies [sic] these corresponding to the henceforth refined, additional finishing commands. The conversion occurs automatically via the CIS computer program module 50 and thus guarantees an inherently logical result tuned or, respectively, synchronized to one another [sic].

15

The resulting new formdef file 51 contains new medium maps, whereby the designations "LI\_ACC1", etc. are purely voluntary and can be completely automatically as well as randomly generated by the CIS computer program module. However, a designation assigned once is then retained. In all cases, the  
20 new medium maps replace the preceding ACCOUNT medium maps of the original formdef file 23.

Further details of the CIS computer program module 50 can be learned from WO 01/77807 A2 and PCT/EP02/05299, which is herewith again explicitly  
25 incorporated into the present specification. An important functionality of the CIS computer program module 50 that are [sic] addressed in the older WO publication '807 is the normalization of the data of the input print data file 22. It is converted and, if applicable, re-sorted in step S10 such that identical job types and/or identical customers are mutually printed out in succession, such that the  
30 subsequent processing of the documents (stacking, enveloping, stapling, etc.) is simplified.

The modified print file 52 and the modified formdef file 51 are supplied in step S11 to a host printer driver 24 that conveys the AFP data stream in an APDS data stream to an IPDS- and UP<sup>3</sup>I-capable printer. The UP<sup>3</sup>I commands that are  
5 contained in the medium maps are converted into corresponding IPDS triplets before they are sent to the printer (step S11).

As already in Figures 2 and 3, in the exemplary embodiment of Figure 4 the print good generated with the method is also comprised of five pages for customer 1 and  
10 its first account, three pages for the second account of the customer 1 and two pages for the customer 2. This time, the pages are stacked, shifted and foil-welded as this has been requested by the user.

Due to the structural correspondence between input file 22 and control file 46, the  
15 effort to introduce auxiliary device functionalities (such as UP<sup>3</sup>I functions) into an existing application of a resource-structured print data stream is relatively small. Via the automation, a secure conversion can occur independent of the size of the application (number of the documents, pages and/or mail pieces) and the number of the medium maps in the form definition file. Furthermore, the specifications of  
20 the original form definition file 23 are not necessary, such that the AFP user that wants to implement a UP<sup>3</sup>I data extension does not need any access to the original control file with which the original formdef file 23 was generated. An AFP user who wants to implement additional device functionalities in the data stream also needs no access to an original PPFA control file or to the application program that  
25 has originally generated the data stream, because he only inserts the additional commands into the data stream, including the formdef file 23, on a comfortable operator interface.

In step S11, the modified print data file 52 and the modified formdef file 51 are  
30 converted by the host printer driver 24 into an IPDS data stream, and this IPDS print data stream is output to the printing system 25 for output. In step S12, this

produces three documents 28, 29 and 30 as they have already been explained in detail using Figures 2 and 3.

In the exemplary embodiments cited above, AFP print data have respectively been  
5 enhanced with finishing commands in order to subject documents to a print pre-  
processing and/or a print post-processing in various manners. However, the  
invention is suitable not only for AFP print data streams or, respectively,  
corresponding resource-structured input files but rather can, for example, also be  
applied for what is known as line data that are inherently unstructured. By means  
10 of a suitable computer program module, for example the known computer program  
ACIF by the company IBM or the computer program "CIS" 50 already used in the  
present invention, which is also explained in detail in WO 01/77807, such line data  
can be converted such that the line file is converted into a structured file by means  
of what is known as a pagedef file. This structured file then corresponds to the  
15 print data file 22 of the exemplary embodiments illustrated above and can in turn,  
by means of a corresponding formdef file 23, be automatically converted with the  
invention into an output file 52 enhanced with finishing commands.

In addition to line data, Extendable [sic] Markup Language data (XML data) can  
20 also be enhanced with finishing operations. The XML standard is primarily a well-  
known standard in the field of Internet pages. Personalized Printer Markup  
Language data (PPML data) can also be enhanced with finishing commands with  
the present invention. Finally, it is also possible to process further known types of  
document data streams such as, for example, data of the Printer Control [sic]  
25 Language (PCL) in the inventive manner. Finishing commands can thereby  
already be contained in the original data stream (PCL), the PCL data stream can be  
converted into an AFP data stream and the already-existing finishing commands  
can thereby be adopted and optionally enhanced with additional finishing  
commands. The enhancement then occurs in the inventive manner.

Finally, with the invention it is also conceivable to effect a data reduction instead of a data enhancement, i.e. to reduce a print data input file that contains finishing operations by these operations. The fundamental inventive workflow, with the creation of a control file that defines specific levels and assigns certain finishing  
5 operations to these levels, is thereby maintained. Only the removal of finishing commands is established instead of the addition of finishing commands. It can just as well be provided to exchange finishing commands, whereby, for example, finishing commands that, set up on a specific type or a specific version of finishing device [sic], are to be replaced by correspondingly changed types or versions. This  
10 can in particular be advantageous when a file to be printed contains finishing commands of a specific standard (for example UP<sup>3</sup>I) and should be processed on a system that does not fulfill this standard, for example is not UP<sup>3</sup>I-capable. Furthermore, the invention enables finishing commands or, respectively, data of a first standard to be replaced by finishing commands or, respectively, data of a  
15 second standard, for example when an application should run on a new system.

With the invention, the fundamentals are achieved to very flexibly deal with print data streams in more or less complex print production systems in which the data, documents or, respectively, recording media are processed in a plurality of devices.

20 Given the conversion of a PCL or PS (Postscript) data stream into AFP, it can additionally be provided that the formdef file is created in a course with the conversion of the print data file, i.e. it is formed "on the fly", so to speak. The modified print data file and the modified formdef file for processing of the print  
25 job in a printing system with finishing commands can then directly and very quickly occur with both of these files (formdef file and print data file) and the inventive control file generated by the user.

The invention can in particular be realized as a computer program (software). It  
30 can therewith be distributed as a computer program module, as a file on a data medium such as a diskette or CD-ROM, or as a file via a data or, respectively,

communication network. Such and comparable computer program products or computer program elements are embodiments of the invention. The inventive procedure can be used in a computer, in a print device and/or in a printing system with upstream or downstream data processing devices, in particular when the

5 computer program runs on a suitable computer and there effects an inventive method procedure. It is thereby clear that corresponding computers on which the invention is used can comprise further known technical devices such as input means (keyboard, mouse, touchscreen), a microprocessor, a data or, respectively, control bus, a display device (monitor, display) as well as a working storage, a

10 fixed disc storage and a network card.



Reference list

	1a...1c	first group of documents
	2a...2c	second group of documents
5	3a...3c	mail pieces (shipments)
	3	host computer
	4	processing computer (file server)
	5	network architecture
	6	output device
10	6a...6d	print devices
	7	monitoring system
	7a	monitoring computer
	7b	databank
	7c	computer program modules
15	8	print manager
	9	converter
	10a, 10b	read station
	11a, 11b	hand barcode reader
	12, 12a	client computer (user network)
20	13	network for client
	14a...14d	print data lines
	15	device controller network
	16	print server
	16a	screen
25	17	test system
	17a	optical test system
	17b	barcode test system
	17c	MICR test system
	17d	data acquisition module
30	18a	cutter
	18b	enveloper

	19	print good
	20	formatting computer program
	21	control file
	22	print data file
5	23	formdef file
	24	host printer driver
	25	printing system
	26	first print device
	27	second print device
10	28	first document
	29	second document
	30	third document
	31	PPFA control file
	31a	first part of the PPFA control file
15	31b	second part of the PPFA control file
	32	PPFA computer program
	33	PPFA formdef file
	34	print data file
	35	post-processing steps
20	36	post-processing steps
	40	job bracket
	41	customer bracket
	42	first account bracket
25	43	second account bracket
	44	second customer bracket
	45	third account bracket
	46	control file
	47	definition range for finishing operations
30	48	definition range for levels
	49	definition range for associations

	50	CIS computer program module
	51	modified formdef file
	52	modified print data file
5		
	S1	generation of the control file
	S2	modification of the print data file
	S3	generation of the IPDS print data stream
	S4	print out
10	S5	generation of the PPFA control file
	S6	generation of the PPFA formdef file
	S7	generation of the control file 46
	S8	generation of the IPDS data stream
	S9	generation of the new formdef file
15	S10	conversion process for variable print data
	S11	conversion AFP → IPDS
	S12	document production